Search for $\eta \to e^+e^-$ decay in WASA experiment

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In this talk the preliminary analysis dedicated to a search for the very rare $\eta \to e^+e^-$ decay will be presented. The analysis was performed with WASA detector working at COSY storage ring. Data sample was collected using the reaction $pp \to pp\eta$ at the incident proton energy of 1.4 GeV and corresponds to about $5 \cdot 10^7$ produced eta mesons used for the analysis.

The experiment WASA-at-COSY at COoler SYnchrotron in Jülich focuses on investigation of production and decays of various light mesons like π°, η and ω. In those decays we are especially interested in searching for symmetry breaking mechanisms and looking for the processes that could indicate the presence of a new physics.

The COSY synchrotron accelerates protons and deuterons with momenta up to 3.7 GeV/c. The WASA target constructed with the aim to minimize the photon conversion in the target uses unique system of droplets of frozen hydrogen or deuterium injected to cross the COSY beam. The decays are measured in the WASA detector which covers nearly 4π of decay space. Energies and angles of the scattered particles emitted at small polar angles are precisely measured in forward detector. Decay products of mesons are studied with central detector consisting of drift chamber placed in magnetic field, plastic barrel of scintillators and electromagnetic calorimeter.

$\eta \to e^+e^-$ decay has an expected branching ratio in the order of 10^{-9} in the Standard Model, if one assumes that the electron-positron pair is produced in the fourth order electromagnetic process with two intermediate photons. This fact makes it very sensitive to possible nonconventional interaction which could lead to significant increase of the branching ratio (BR). The observation of an excess would indicate the possible interaction from beyond the Standard Model. The current experimental upper limit for $\mathrm{BR}(\eta \to e^+e^-) < 2.7 \cdot 10^{-5}$ (90% CL) [1] was obtained with very similar conditions but with forty times smaller number of the eta mesons collected. Evaluation of trigger used in experiment, cut optimization procedure, and statistically significant data sample of some other leptonic decays will be shown and discussed. A few times better upper limit for $\eta \to e^+e^-$ decay will be also presented.

[1] M. Berłowski *et al.*, "Measurement of eta meson decays into lepton-antilepton pairs" Phys. Rev. D **77**, 032004 (2008).

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